Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	MONOMEROS NITROUS OXIDE ABATEMENT PROJECT	
UNFCCC reference number of the project activity	1428	
Version number of the PDD applicable to this monitoring report	03	
Version number of this monitoring report	01.2	
Completion date of this monitoring report	28/03/2019	
Monitoring period number	#5	
Duration of this monitoring period	30/03/2012-13/02/2015	
Monitoring report number for this monitoring report	01	
Project participants	Monomeros Colombo Venezolanos S.A.- MGM Carbon Portfolio, S.A.R.L.- Bunge Emissions Fund Limited. Allcot Colombia SAS	
Host Party	Colombia	
Sectoral scopes	5 - Chemical industries	
Applied methodologies and standardized baselines	AM0028 ver. 4 - Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants AM0034 ver. 2 - Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	83,853	166,375

project activity in this monitoring period		
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	366,150	

SECTION A. Description of project activity

A.1. General description of project activity

The current project activity is taking place at the nitric acid plant owned by Monomeros Colombo Venezolanos S.A. (MCV) in Barranquilla, Atlántico State, Colombia has installed a secondary catalyst below the primary one, inside the ammonia burner, which destroys the N_2O transforming it in N_2 and O_2.

Nitrous oxide (N_2O) is an undesired by-product gas from the manufacture of nitric acid. Nitrous oxide is formed during the catalytic oxidation of ammonia. Over a suitable catalyst, a maximum 98% (typically 92- 96%) of the ammonia fed is converted to nitric oxide (NO). The remainder participates in undesirable side reactions that lead to the production of nitrous oxide, among other compounds.

Waste N_2O from nitric acid production is typically released into the atmosphere, as it does not have any economic value or toxicity at typical emission levels. N_2O is an important greenhouse gas which has a high global warming potential (GWP) of 310.

In order to monitor the emission, the plant installed an Automated Monitoring System (AMS), consisting of an Infrared Gas Analyzer and a Gas Flow meter, at the stack.

Relevant dates for the monitoring period:

Campaigns	Dates
Baseline campaign	15/02/2007-17/02/2008
CDM Project registration date	14/02/2008
1st Project Campaign	9/03/2008 - 24/03/2009
2nd Project Campaign	25/03/2009 - 03/05/2010
3rd Project Campaign	04/05/2010-12/05/2011
4th Project Campaign	13/05/2011-29/03/2012
5th Project Campaign	**30/03/2012-17/01/2013**
6th Project Campaign	**25/01/2013-03/02/2014**
7th Project Campaign	**06/02/2014-18/01/2015**

During the present monitoring period there were three project campaigns. The calculations have been made for the three of them.

A.2. Location of project activity

The project activity is located in the nitric acid plant owned by MCV in Barranquilla city, Atlántico State, Colombia: Latitude 11º 10’ N Longitude 74º 50’ W

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host)	Monomeros Colombo Venezolanos S.A. (Private entity)	NO
Switzerland	Bunge Emissions Fund Limited (Private entity)	NO

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Switzerland	MGM Carbon Portfolio, S.A.R.L.	NO
Colombia	ALLCOT Colombia SAS	YES

A.4. Reference to applied methodologies and standardized baselines

The selected methodologies are:

- AM0034 "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants" version 02 (EB 27).
- AM0028 "Catalytic reduction of N_2O in the tail gas of Nitric Acid or Caprolactam Productions Plants" version 04.1 (EB 28) is used to select the baseline scenario.

It was also used the "*Tool for the demonstration and assessment of additionality*" version 03 (EB 29) to demonstrate additionality.

A.5. Crediting period type and duration

14/02/2008 to 13/02/2015 (renewable)

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The Nitric Acid Plant has been operating since 1970.

The Baseline campaign started on 15/02/2007 and ended on 17/02/2008. The project was registered on 14/02/2008.

- The First Project Campaign took place between 09/03/2008 and 24/03/2009, although the first monitoring period began on 14/02/2008. Between 13/02/2008 and 08/03/2008 the plant was shut down and no emission reductions were generated.
- The Second Project Campaign took place between 25/03/2009 and 03/05/2010.
- The Third Project Campaign took place between 04/05/2010 and 12/05/2011.
- The Fourth Project Campaign took place between 13/05/2011 and 29/03/2012.
- The Fifth Project Campaign took place between 30/03/2012 and 17/01/2013.
- The Sixth Project Campaign took place between 25/01/2013 and 03/02/2014.
- The Seventh Project Campaign took place between 06/02/2014 and 18/01/2015.

The Project is operating according to the monitoring plan established in the registered PDD version 03 dated 20/09/2007.

Resolution 909/2008[1] , which includes new limits for NO_X emissions, was issued by the Ministerio de Ambiente, Vivienda y Desarrollo Territorial (Environmental, Housing and

[1] 1 http://www.minambiente.gov.co/documentos/res_0909_050608.pdf

Territorial Development Ministry) on 5 June 2008. The Resolution came into force on June 5, 2010, two years after its publication.

According to the approved monitoring methodology AM0034 ver. 2, "Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants", in the case of new NOx regulations the re-assessment of the baseline scenario shall be undertaken using the same 5-Step process used for baseline scenario selection, and the additionality of the project must be re-demonstrated.

The above mentioned Resolution, however, has no effect whatsoever on the project activity since the NO_X emissions at the Monómeros plant were already below the limits on NO_X emissions imposed by the new regulation since the beginning of the baseline campaign. Therefore, the baseline scenario selected in the PDD, the continuation of the status quo, remains valid, as does the demonstration of additionality described in the registered PDD[2].

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

There have been no deviations in the applied methodology.

B.2.2. Corrections

No correction is requested.

B.2.3. Changes to the start date of the crediting period

No change to the start date of the crediting period is requested.

B.2.4. Inclusion of monitoring plan

Not applicable

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

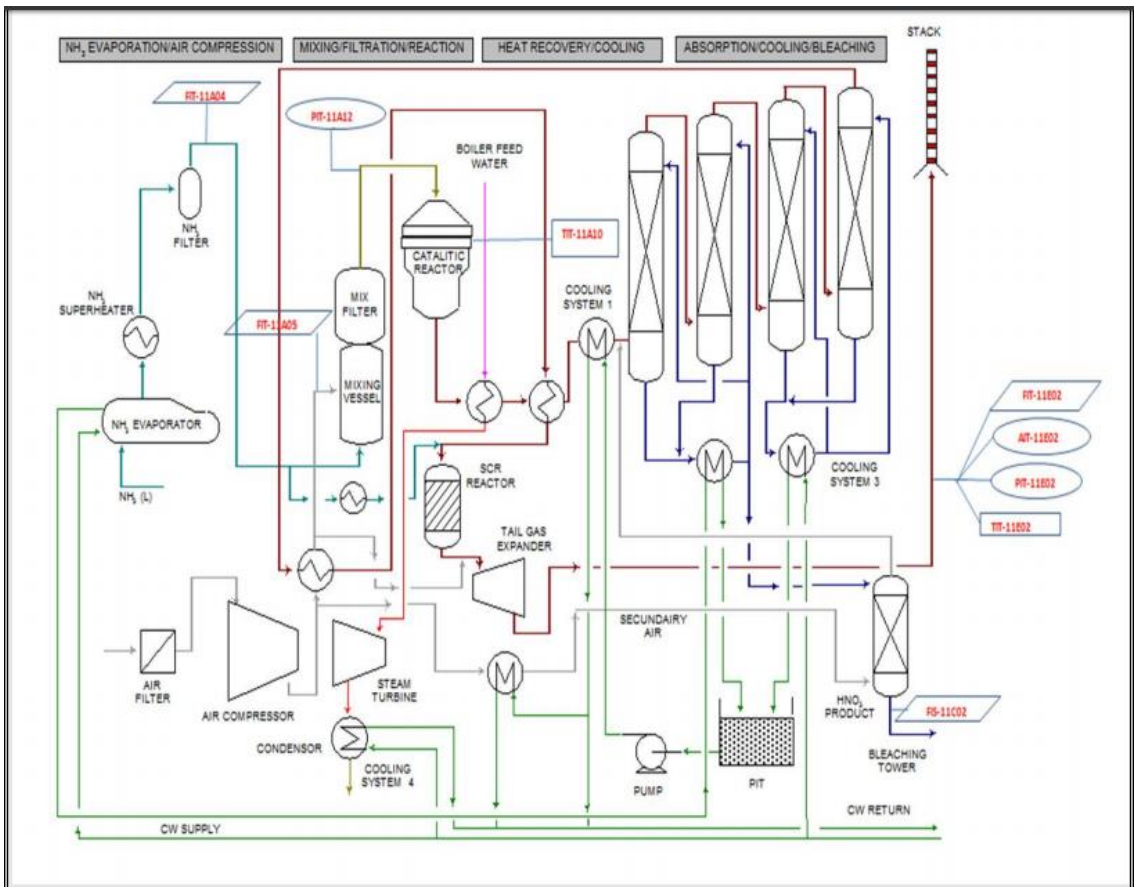
No changes to the monitoring plan or applied methodology as described in the registered CDM-PDD ver 03.0 dated 20/09/2007 have been requested.

B.2.6. Changes to project design

No changes to the project design are requested.

[2] On 16 March 2009, Monómeros Colombo Venezolanos S.A. received a compliance certificate from the regional authority (DAMAB - Departamento Administrativo del Medio Ambiente de Barranquilla – www.damab.gov.co/) confirming that the Monómeros Colombo Venezolanos S.A. production facilities are operated according to Decreto 02 de 1982 del Ministerio de Salud de la República de Colombia. NOx emissions tests are archived by Monómeros Colombo Venezolanos S.A. as well as by DAMAB and were presented to the DOE during on-site verification. Upon request, they can be made available to the CDM EB

SECTION C. Description of monitoring system



The relation between the project operational and management structure, and other actors of the proposed CDM project activity, is described as follows:

- The responsible Plant Operator is in charge of the supervision of the data acquisition system (DAS) that is implemented to record plant operation data. The Plant Operator reports the relevant data generated by the DAS to the Monitoring Engineer.
- The Monitoring Engineer is the plant staff member in charge of processing the data generated by the DAS. The Monitoring Engineer receives the relevant plant data from the responsible Plant Operator. These data are entered into a spreadsheet especially designed for the monitoring plan.
- The Plant Manager is responsible for ensuring that the CDM project activity at plant level is implemented in compliance with the registered PDD and other relevant standards. The Plant Manager routinely reports to the General Manager for Operations on the overall progress of the CDM project activity. At any time that the Plant Manager wants or needs to follow the implementation of the CDM project activity, he/she asks for a report from the Monitoring Engineer. Periodically the Plant Manager sends the monitoring report to the DOE in charge of performing the verification.
- MCV Metrology and Engineering Groups are available at all times to support the Monitoring Engineer in case of personnel loss or changes. The relevant Plant Manager also has MCV Metrology and Engineering Groups available as resources for assistance when required.

- The DOE performs the verification and subsequently submits the corresponding verification report to the CDM Executive Board. MCV shareholders receive annually from the Plant Manager, the same report as is sent to the DOE

Description of the AMS

The Monomeros plant has installed a continuous gas analyzer from the supplier ABB, model AO2000. The specific module that is used to measure gas N_2O is a URAS 14 non-dispersive infrared gas analyzer. The URAS 14 has been on the market for several years and has proven to be a reliable instrument; this module is certified by TÜV to comply with German 27th BlmSchV regulation for several compounds (such as CO, NO, SO2).

For stack flow measurement, the plant selected as primary meter an Annubar principle (multiple pressure differentials) unit, model 485 Annubar primary, manufactured by Rosemount Inc. (USA).

Good monitoring practice and performance characteristics

The European Norm EN 14181:2004 is recommended as guidance regarding the selection, installation and operation of the AMS under Monitoring Methodology AM0034, and stipulates three levels of Quality Assurance Levels (QAL):

QAL1: Suitability of the AMS for the specific measuring task.

The EN 14181: 2004 QAL1 report was provided by the equipment manufacturer considering the performance characteristics as measured by a qualified Technical Inspection Authority and the specific installation characteristics and site conditions at the plant. The QAL1 report confirmed that the N_2O analyzer (AO 2000- URAS 14 NDIR supplied by ABB GmbH) is suitable to perform the indicated analysis (N_2O concentration).

QAL2: Validation of the AMS following its installation.

QAL2 describes a procedure for the determination of the calibration function and its variability, by means of certain number of parallel measurements, performed with a Standard Reference Method. The testing laboratory performing the measurements with the Standard Reference Method shall have an accredited quality assurance system according to EN ISO/IEC 17025 or relevant (national) standards.

QAL2 test were performed in May 2007 and on May 2011, by SGS Environmental Services (Accredited according to EN ISO / IEC 17025). The QAL2 report is available for DOE review. The report concludes the monitoring system complies with the standard. In order to keep records of AMS data before and after QAL2 test as generated (un-manipulated data), the corrective formulae (calibration functions) were applied during data processing (with the aid of spreadsheets), meaning calibration functions were not programmed on the Distributed Control System (DCS) of the plant (which functions as data acquisition system).

QAL3: Ongoing quality assurance during operation.

QAL3 of EN 14181: 2004 check for drift and precision, in order to demonstrate that the AMS is in control during its operations so that it continues to function within the required specification for uncertainty. This was achieved by conducting periodic zero and span checks on the AMS, and evaluating results obtained using control charts. Results of periodic calibrations were analyzed graphically with the aid of Shewhart charts. All monitoring equipment has been serviced and maintained according to the manufacturer's instructions and international standards by qualified personnel. Calibration and maintenance records are well kept at Monomeros plant and available for auditing purposes.

AST: annual surveillance test (AST)

The AST is a procedure to evaluate whether the measured values obtained from the AMS still meet the required uncertainty criteria, as evaluated during the QAL2 test. As with the QAL2, it also requires a limited number of parallel measurements using an appropriate standard reference method. AST 2009, AST 2010, AST 2011 and AST 2012 were performed by SGS Environmental Services (Accredited according to EN ISO / IEC 17025) in June 2009, June 2010, May 2011, and May 2012 respectively. The AST reports are available for DOE review. The reports conclude the following: The QA/QC system complies with the requirements of EN 14181 QAL3; the gas analyzer passed the test on variance, suitability and linearity; the flow meter passed the test on variance and suitability; and data given by the instruments at the stack comply with the data registered in the data acquisition system.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	**B.11 AFR_{max}**
Unit	kg NH_3/hour
Description	Maximum Ammonia Flow Rate
Source of data	Specified by the ammonia oxidation catalyst manufacturer
Value(s) applied	3.282
Choice of data or measurement methods and procedures	Maximum ammonia load as specified by the primary catalyst manufacturer was used to determine maximum ammonia flow rate.
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

Data/Parameter	**B.14 CL_{normal}**
Unit	tonne 100% HNO_3
Description	The normal campaign length is defined as the average campaign length for the five historic campaigns used to define operating conditions. Campaign length is defined as the total number of metric tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Source of data	Historical data
Value(s) applied	• 5^{th} campaign: 82,312 • 6^{th} campaign: 79,066 • 7^{th} campaign: 76,693

Choice of data or measurement methods and procedures	Previous five campaigns are used in the calculations for this monitoring period. For more details see the document "Normal campaign length Reviewed-Dic2018.xls"
Purpose of data/parameter	Baseline and project emission calculations
Additional comments	Campaign number 127 was eliminated because it was abnormal (physical damage observed in the primary catalyst). The average of the last five campaigns is used in each project campaign.

Campaign number	Date of installation	Date of removal	HNO_3 production
128	03/04/2003	11/02/2004	74,553
129	12/02/2004	04/01/2005	79,271
130	07/01/2005	23/01/2006	89,287
131	12/02/2006	14/02/2007	89,548
132	15/02/2007	18/02/2008	89,923
133	**30/03/2012**	**17/01/2013**	**63,530**
134	**25/01/2013**	**03/02/2014**	**63,041**
135	**06/02/2014**	**18/01/2015**	**77,425**

Data/Parameter	**B.15 $AIFR_{max}$**
Unit	kg NH_3/kg air
Description	Maximum Ammonia to Air Flow Rate to the ammonia oxidation reactor
Source of data	Specified by the ammonia oxidation catalyst manufacturer.
Value(s) applied	0.066
Choice of data or measurement methods and procedures	Maximum load as specified by the primary catalyst manufacturer was used to determine maximum ammonia to air flow rate.
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

Data/Parameter	**B.17 OT_{normal}**
Unit	ºC
Description	Normal Range for Oxidation Temperature of the ammonia reactor
Source of data	Historical process data.
Value(s) applied	832-872 ºC
Choice of data or measurement methods and procedures	Monomeros Plant has complete historical registers for oxidation temperature (five historical campaigns); then, historical data is used to determine normal oxidation temperature. Reactor temperature was measured by a thermocouple installed through the reactor wall, near the oxidation catalyst; the signal from such device is acquired by the Distributed Control System (DCS) and stored electronically
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

Data/Parameter	**B.19 OP_{normal}**
Unit	Pa(abs)
Description	Normal Range for Oxidation Pressure of the ammonia reactor
Source of data	Design data
Value(s) applied	303.948- 384.890

Choice of data or measurement methods and procedures	Plant design data was used to determine normal oxidation pressure.
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

Data/Parameter	**B.20 GS_{normal}**
Unit	N.A
Description	Gauze supplier during operating condition campaigns (the previous campaigns).
Source of data	Historial process data
Value(s) applied	Johnson Matthey PLC
Choice of data or measurement methods and procedures	Johnson Matthey supplied primary catalyst for the previous campaigns. Umicore supplied catalyst for fifth representative historical campaign.
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

Data/Parameter	**B.23 GC_{normal}**
Unit	%
Description	Gauze composition for the operation condition campaigns (the previous five campaigns).
Source of data	Historial process data
Value(s) applied	90.0 % Pt, 10.0 % Rh.
Choice of data or measurement methods and procedures	Such gauze composition delivered acceptable performance (as per contractual basis considering commercial/economic issues)
Purpose of data/parameter	The data is used for baseline emission calculation
Additional comments	

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/Parameter	**P.1 NCSG**
Unit	mg N_2O/Nm^3 (converted from ppm if necessary)
Description	N_2O concentration in the stack gas for the project campaign
Measured/calculated/ default	Measured/Calculated - every 2 s used for calculation of campaign mean (average, after exclusion of extreme values and outliers)
Source of data	AMS (Infrared gas analyser) at MCV's plant.
Value(s) of monitored parameter	5^{th} campaign: 536.09 6^{th} campaign: 187.32 7^{th} campaign: 1393.97

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td></td><td>AIT-11E02</td></tr>
<tr><td>Type</td><td>AO2000 continuous gas analyzer, with analysis module URAS 14 (infrared photometer)</td></tr>
<tr><td>Serial Number</td><td>S/N: 4606448/1000</td></tr>
<tr><td>Calibration Frequency:</td><td>Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.</td></tr>
<tr><td>Date of previous calibration:</td><td>QAL2: 26/05/2011</td></tr>
<tr><td>Date of last calibration:</td><td>QAL2:
7/05/2012
15/04/2014
9/03/2015</td></tr>
<tr><td>Validity:</td><td>QAL2: 5 years</td></tr>
<tr><td>Overall measurement accuracy:</td><td>±5 ppm</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Every two seconds</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N.A</td></tr>
<tr><td>QA/QC procedures</td><td>Procedure I-6321-001 “Instructions for Adjustment and Calibration of the N2O Analyzer of the 11 plant”, AST and QAL2 test according to EN 14181.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Project emissions calculations</td></tr>
<tr><td>Additional comments</td><td></td></tr>
</table>

Data/Parameter	**P.2 VSG**
Unit	Nm^3/hour
Description	Volume flow rate in the stack gas for the project campaign
Measured/calculated/ default	Measured - every 2 sec. used for calculation of campaign mean (average, after exclusion of extreme values and outliers
Source of data	AMS (flow meter) at MCV’s plant.
Value(s) of monitored parameter	5^{th} campaign: 36,535 6^{th} campaign: 36,391 7^{th} campaign: 34,761

Monitoring equipment	<table><tr><td></td><td>FIT-11E02</td></tr><tr><td>Type</td><td>Annubar type Flow Transmitter Rosemount 3095MFA (multiple pressure differential principle)</td></tr><tr><td>Serial Number</td><td>S/N Tx: 0022859 - S/N Sensor: 3081256</td></tr><tr><td>Calibration Frequency:</td><td>Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.</td></tr><tr><td>Date of previous calibration:</td><td>QAL2: 26/05/2011</td></tr><tr><td>Date of last calibration:</td><td>QAL2: 24/01/2013 04/02/2014 </td></tr><tr><td>Validity:</td><td>QAL2: 5 years</td></tr><tr><td>Overall measurement accuracy:</td><td>0.0049 in H_2O</td></tr></table>
Measuring/reading/recording frequency	Every two seconds
Calculation method (if applicable)	N.A
QA/QC procedures	According with standard EN 14181. AST is performed on an annual basis.
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.3 PE_n**
Unit	Tonne N_2O
Description	N_2O emission of the project campaigns
Measured/calculated/ default	Calculated
Source of data	Calculated from monitored data
Value(s) of monitored parameter	5^{th} campaign: 128.72 6^{th} campaign: 50.70 7^{th} campaign: 396.32
Monitoring equipment	N.A
Measuring/reading/recording frequency	Once, at the end of the project campaign
Calculation method (if applicable)	N.A
QA/QC procedures	According to applied methodology
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.4 OH**
Unit	Hour
Description	Total operating hours for the project campaign

Measured/calculated/ default	Measured
Source of data	Process control system at MCV´s plant
Value(s) of monitored parameter	5th campaign: 6,572.00 6th campaign: 7,438.00 7th campaign: 8,179.00
Monitoring equipment	N.A
Measuring/reading/recording frequency	Daily
Calculation method (if applicable)	The distributed control system of the plant will record effective operating time of the plant by monitoring periods when the value registered for the hourly average of the oxidation reactor temperature reaches a value of 650oC to 900 °C.
QA/QC procedures	This Thermocouple is changed every campaign. In the reactor at the same distance of the gauzes is installed another temperature meter which can be used to compare the data of the first in case of a failure.
Purpose of data/parameter	Project emissions calculations
Additional comments	The operating days are calculated according to the time that the plant was in service (ON) during the campaign (for more details see the documents: • MCV_ Fifth_Project_ Campaign_ver 1.0.xls. • MCV_ Sixth_Project_ Campaign_ver 1.0".xls • MCV_ Seventh_Project_ Campaign_ver 1.0".xls

Data/Parameter	**P.5 NAP**
Unit	Tonne 100% HNO_3
Description	Total nitric acid production for the project campaign
Measured/calculated/ default	Measured
Source of data	Production logs of MCV's plant.
Value(s) of monitored parameter	5th campaign: 65,530 6th campaign: 63,041 7th campaign: 77,425[3]

[3] NAP for the project campaigns included in this monitoring period did not exceed the design capacity. The design capacity of MCV plant is 275 tonne HNO3/day, therefore the nameplate capacity is 100,375 tonne HNO3 considering 365 days as per definition of nameplate capacity. The total production of fifth, sixth and seventh project campaigns calculated were 232.50, 197.54 and 227.19 tonne HNO3/day, therefore, they didn't exceed in none of them the nameplate capacity (for more details see the document "MCV_ Fifth_ Project_ Campaign_ver 1.0".xls, "MCV_ Sixth_ Project_ Campaign_ver 1.0".xls and "MCV_ Seventh_ Project_ Campaign_ver 1.0".xls).

Monitoring equipment		FIT-11C02	FIT-12N09
	Type	Mass Flow Transmitter (Coriolis) Micro Motion CMF200	Mass Flow Transmitter (Coriolis) Micro Motion CMF050
	Serial Number	S S/N Tx: 390682 - S/N Sensor: 2203854	S/N Tx: 3043896 – S/N Sensor: 486759
	Calibration Frequency:	Calibrated every campaign according to metrology procedures.	Calibrated every campaign according to metrology procedures.
	Date of previous calibration:	13/05/2011	12/07/2011
	Date of last calibration:	04/04/2012 25/01/2014 04/02/2015	25/03/2012 24/01/2013 20/05/2014
	Validity:	Every campaing	Every campaign
	Overall measurement accuracy:	0.1%	0.1%
Measuring/reading/recording frequency	Daily		
Calculation method (if applicable)	Daily production is measured directly by a mass flow meter (Coriolis principle) that records the combined Nitric acid produced by both the Nitric Acid Plant and the Caprolactam Plant; the device also measures density and temperature, so concentration correction is done automatically with the help if the DCS. The specific Caprolactam Plant production is measured by a second device of the Coriolis type. The DCS calculates the daily production of the nitric acid plant as the difference between the first (Coriolis) and second (Coriolis) device measurements.		
QA/QC procedures			
Purpose of data/parameter	Project emissions calculations		
Additional comments	The operating days are calculated according to the time that the plant was in service (ON) during the campaign (for more details see the documents: • MCV_ Fifth_Project_ Campaign_ver 1.0.xls. • MCV_ Sixth_Project_ Campaign_ver 1.0".xls • MCV_ Seventh_Project_ Campaign_ver 1.0".xls		

Data/Parameter	**P.6 TSG**
Unit	ºC
Description	Temperature of the stack gas during the project campaign
Measured/calculated/ default	Measured
Source of data	AMS (Flow meter)
Value(s) of monitored parameter	5th campaign: 120.47 6th campaign: 116.79 7th campaign: 125.75

Monitoring equipment		TIT-11E02
	Type	Multivariable Transmitter Rosemount Annubar type flow 3095MFA
	Serial Number	S/N Tx: 0022859 - S/N Sensor: 3081256
	Calibration Frequency:	Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.
	Date of previous calibration:	26/05/2011
	Date of last calibration:	• 04/03/2012 • 04/01/2013 • 04/02/2014
	Validity:	5 years
	Overall measurement accuracy:	±0.013ºC
Measuring/reading/recording frequency	Every two seconds	
Calculation method (if applicable)	N.A	
QA/QC procedures	AST and QAL2 test according to EN 14181	
Purpose of data/parameter	Project emissions calculations	
Additional comments		

Data/Parameter	**P.7 PSG**
Unit	Kgf/cm^2
Description	Pressure of the stack gas during the project campaign
Measured/calculated/ default	Measured
Source of data	AMS (Flow meter)
Value(s) of monitored parameter	5^{th} campaign: 1.04 6^{th} campaign: 1.04 7^{th} campaign: 1.03

Monitoring equipment	<table><tr><td></td><td>PIT-11E02</td></tr><tr><td>Type</td><td>Multivariable Transmitter Rosemount Annubar type flow 3095MFA</td></tr><tr><td>Serial Number</td><td>S/N Tx: 0022859 - S/N Sensor: 3081256</td></tr><tr><td>Calibration Frequency:</td><td>Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.</td></tr><tr><td>Date of previous calibration:</td><td>26/05/2011</td></tr><tr><td>Date of last calibration:</td><td>04/03/2012 04/01/2013 04/02/2014</td></tr><tr><td>Validity:</td><td>5 years</td></tr><tr><td>Overall measurement accuracy:</td><td>± 0.0015 kg/cm^2</td></tr></table>
Measuring/reading/recording frequency	Every two seconds
Calculation method (if applicable)	N.A
QA/QC procedures	AST and QAL2 test according to EN 14181
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.8 EF_n**
Unit	tonne N_2O / tonne 100% HNO3
Description	Project emission factor calculated from monitored data for the project campaign
Measured/calculated/ default	Calculated
Source of data	Calculated from monitored data
Value(s) of monitored parameter	5th campaign: 0.00203 6th campaign: 0.00080 7th campaign: 0.00512
Monitoring equipment	n.a
Measuring/reading/recording frequency	Once for each campaign
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.9 $EF_{ma,n}$**
Unit	tonne N_2O / tonne 100% HNO_3
Description	Moving average emission factor

Measured/calculated/ default	Calculated
Source of data	Calculated from monitored data
Value(s) of monitored parameter	5th campaign: 0.00266 6th campaign: 0.00235 7th campaign: 0.00275
Monitoring equipment	N.A
Measuring/reading/recording frequency	Calculated at the end of a campaign “n”
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.12 CLn**		
Unit	tonne 100% HNO3		
Description	The project campaign length for the nth campaign (CLn) is defined as the nitric acid produced during the nth campaign (see project nitric acid production).		
Measured/calculated/ default	Calculated		
Source of data	Production logs of MCV´s plant		
Value(s) of monitored parameter	5th campaign: 63,530 6th campaign: 63,041 7th campaign: 77,425		
Monitoring equipment		FIS-11C02	FIT-12N09
	Type	Mass Flow Transmitter (Coriolis) Micro Motion CMF200	Mass Flow Transmitter (Coriolis) Micro Motion C
	Serial Number	S/N Tx: 390682 - S/N Sensor: 2203854	S/N Tx: 3043896 - S/N S
	Calibration Frequency:	s calibrated every campaign according to metrology procedures.	s calibrated every campa procedures.
	Date of previous calibration:	13/05/2011	12/07/2011
	Date of last calibration:	• 04/04/2012 • 25/01/2014 • 04/02/2014	• 25/03/2012 • 24/01/2013 • 20/05/2014
	Validity:	Every campaign	Every campaign
	Overall measurement accuracy:	0.1%	0.1%
Measuring/reading/recording frequency	Calculated once at the end of the project campaign		

Calculation method (if applicable)	Daily production is measured directly by a mass flow meter (Coriolis principle) that records the combined Nitric acid produced by both the Nitric Acid Plant and the Caprolactam Plant; the device also measures density and temperature, so concentration correction is done automatically with the help if the DCS. The specific Caprolactam Plant production is measured by a second device of the Coriolis type. The DCS calculates the daily production of the nitric acid plant as the difference between the first (Coriolis) and second (Coriolis) device measurements.
QA/QC procedures	Procedures PR02A-P005 “Calculation Method for the Production of Nitric Acid Plant” and I-6321-053 “Instructions for Maintenance, Adjustment and Calibration of Mass Flow Transmitters Micromotion”.
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.13 EF_p**
Unit	tonne N_2O/ tonne 100% HNO_3
Description	Emission factor that will be applied to calculate the emission reductions from this specific campaign
Measured/calculated/ default	Calculated
Source of data	Calculated from monitoring data
Value(s) of monitored parameter	5^{th} campaign: 0.00266 6^{th} campaign: 0.00235 7^{th} campaign: 0.00512
Monitoring equipment	N.A
Measuring/reading/recording frequency	Calculated at the end of the nth campaign
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**P.14 EF_{min}**
Unit	tonne N_2O/ tonne 100% HNO_3
Description	The lowest among the emission factors of the 10 first campaigns
Measured/calculated/ default	Calculated
Source of data	Calculated from monitoring data
Value(s) of monitored parameter	N.A
Monitoring equipment	N.A
Measuring/reading/recording frequency	After first ten campaigns of the project crediting period
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**B.1 $NCSG_{BC}$**
Unit	mg N_2O/Nm^3 (converted from ppm if necessary)
Description	N_2O concentration in the stack gas for the baseline campaign
Measured/calculated/ default	Measured
Source of data	AMS (Infrared gas analyser) at MCV's plant.
Value(s) of monitored parameter	5th campaign: 2,021 6th campaign: 1,996 7th campaign: 2,256
Monitoring equipment	<table><tr><td></td><td>AIT-11E02</td></tr><tr><td>Type</td><td>AO2000 continuous gas analyzer, with analysis module URAS 14 (infrared photometer)</td></tr><tr><td>Serial Number</td><td>S/N: 4606448/1000</td></tr><tr><td>Calibration Frequency:</td><td>Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.</td></tr><tr><td>Date of previous calibration:</td><td>QAL2:01/06/2010</td></tr><tr><td>Date of last calibration:</td><td>QAL2:26/05/2012</td></tr><tr><td>Validity:</td><td>QAL2: 5 years</td></tr><tr><td>Overall measurement accuracy:</td><td>±5 ppm</td></tr></table>
Measuring/reading/recording frequency	Every two seconds
Calculation method (if applicable)	N.A
QA/QC procedures	Procedure I-6321-001 "Instructions for Adjustment and Calibration of the N_2O Analyzer of the 11 plant", AST and QAL2 test according to EN 14181.
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.2 VSG_{BC}**
Unit	Nm^3/hour
Description	Volume flow rate in the stack gas for the project campaign
Measured/calculated/ default	Measured

Source of data	AMS (flow meter) at MCV's plant.
Value(s) of monitored parameter	5th campaign: 33,860 6th campaign: 33,942 7th campaign: 33,439
Monitoring equipment	<table><tr><td></td><td>FIT-11E02</td></tr><tr><td>Type</td><td>Annubar type Flow Transmitter Rosemount 3095MFA (multiple pressure differential principle)</td></tr><tr><td>Serial Number</td><td>S/N Tx: 0022859 - S/N Sensor: 3081256</td></tr><tr><td>Calibration Frequency:</td><td>Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them.</td></tr><tr><td>Date of previous calibration:</td><td>QAL2: 05/05/2011</td></tr><tr><td>Date of last calibration:</td><td>QAL2: 24/1/2013-04/02/2014</td></tr><tr><td>Validity:</td><td>QAL2: 5 years</td></tr><tr><td>Overall measurement accuracy:</td><td>0.0049 in H_2O</td></tr></table>
Measuring/reading/recording frequency	Every two seconds
Calculation method (if applicable)	N.A
QA/QC procedures	According with standard EN 14181. AST is performed on an annual basis.
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.3 BE_{BC}**
Unit	Tonne N_2O
Description	N_2O emission during baseline campaign
Measured/calculated/ default	Calculated
Source of data	Calculated from monitored data
Value(s) of monitored parameter	5th campaign: 579.27 6th campaign: 573.55 7th campaign: 638.76
Monitoring equipment	N.A
Measuring/reading/recording frequency	Calculated at least once at the end after the baseline campaign
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	N.A
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.4 OH_{BC}**
Unit	Hour
Description	Total operating hours for the baseline campaign
Measured/calculated/ default	Measured
Source of data	Process control system at MCV´s plant
Value(s) of monitored parameter	8,466
Monitoring equipment	N.A
Measuring/reading/recording frequency	Daily
Calculation method (if applicable)	The distributed control system of the plant will record effective operating time of the plant by monitoring periods when the value registered for the hourly average of the oxidation reactor temperature reaches a value of 650oC to 900 °C.
QA/QC procedures	This Thermocouple is changed every campaign. In the reactor at the same distance of the gauzes is installed another temperature meter which can be used to compare the data of the first in case of a failure.
Purpose of data/parameter	Baseline emissions calculations
Additional comments	The operating days are calculated according to the time that the plant was in service (ON) during the campaign (for more details see the documents: - "MCV_ BLEF Calculation 5TH campaign v01".xls. - "MCV_ BLEF Calculation 6TH campaign v01".xls. - "MCV_ BLEF Calculation 7TH campaign v01".xls.

Data/Parameter	**B.5 NAP_{BC}**		
Unit	Tonne 100% HNO_3		
Description	Total nitric acid production for the baseline campaign		
Measured/calculated/ default	Measured		
Source of data	Production logs of MCV's plant.		
Value(s) of monitored parameter	84,823		
Monitoring equipment		FIT-11C02	FIT-12N09
	Type	Mass Flow Transmitter (Coriolis) Micro Motion CMF200	Mass Flow Transmitter (Coriolis) Micro Motion CMF050
	Serial Number	S S/N Tx: 390682 - S/N Sensor: 2203854	S/N Sensor: 21173
	Calibration Frequency:	Calibrated every campaign according to metrology procedures.	Calibrated every campaign according to metrology procedures.
	Date of previous calibration:	13/05/2011	12/07/2011
	Date of last calibration:	04/04/2012 25/01/2014 04/02/2014	25/03/2012 24/01/2013 20/05/2014
	Validity:	Every campaing	Every campaign
	Overall measurement accuracy:	0.1%	0.1%
Measuring/reading/recording frequency	Daily		

Calculation method (if applicable)	Daily production is measured directly by a mass flow meter (Coriolis principle) that records the combined Nitric acid produced by both the Nitric Acid Plant and the Caprolactam Plant; the device also measures density and temperature, so concentration correction is done automatically with the help if the DCS. The specific Caprolactam Plant production is measured by a second device of the Coriolis type. The DCS calculates the daily production of the nitric acid plant as the difference between the first (Coriolis) and second (Coriolis) device measurements.
QA/QC procedures	
Purpose of data/parameter	Project emissions calculations
Additional comments	The operating days are calculated according to the time that the plant was in service (ON) during the campaign (for more details see the document: - "MCV_ BLEF Calculation 5TH campaign v01".xls. - "MCV_ BLEF Calculation 6TH campaign v01".xls. - "MCV_ BLEF Calculation 7TH campaign v01".xls.

Data/Parameter	**B.6 TSG_{BC}**
Unit	ºC
Description	Temperature of the stack gas during the project campaign
Measured/calculated/ default	Measured
Source of data	AMS (Flow meter)
Value(s) of monitored parameter	5th campaign: 114.14 6th campaign: 113.97 7th campaign: 114.74
Monitoring equipment	TIT-11E02 Type: Multivariable Transmitter Rosemount Annubar type flow 3095MFA Serial Number: S/N Tx: 0022859 - S/N Sensor: 3081256 Calibration Frequency: Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them. Date of previous calibration: 26/05/2011 Date of last calibration: 04/01/2013 Validity: 5 years Overall measurement accuracy: +-0.013ºC
Measuring/reading/recording frequency	Every two seconds

Calculation method (if applicable)	N.A
QA/QC procedures	AST and QAL2 test according to EN 14181
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**B.7 PSG_{BC}**
Unit	Kgf/cm^2
Description	Pressure of the stack gas during the project campaign
Measured/calculated/ default	Measured
Source of data	AMS (Flow meter)
Value(s) of monitored parameter	5th campaign: 1.04 6th campaign: 1.04 7th campaign: 1.05
Monitoring equipment	PIT-11E02 Type: Multivariable Transmitter Rosemount Annubar type flow 3095MFA Serial Number: S/N Tx: 0022859 - S/N Sensor: 3081256 Calibration Frequency: Regular calibrations according to vendor specifications and recognized industry standards (EN 14181) as reference method. The EN 14181 recommends developing annual AST (Annual Surveillance Test), periodical (monthly) checking of Zero and Span (QAL3) and based on drift results adjust them. Date of previous calibration: 26/05/2011 Date of last calibration: 04/02/2014 Validity: 5 years Overall measurement accuracy: ±0.0015 kg/cm^2
Measuring/reading/recording frequency	Every two seconds
Calculation method (if applicable)	N.A
QA/QC procedures	AST and QAL2 test according to EN 14181
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**B.8 EF_{BL}**
Unit	tonne N_2O / tonne 100% HNO3
Description	Baseline N_2O emission factor
Measured/calculated/ default	Calculated
Source of data	Calculated from monitored data
Value(s) of monitored parameter	5th campaign: 0.00655 6th campaign: 0.00639 7th campaign: 0.00722

Monitoring equipment	
Measuring/reading/recording frequency	Calculated once at the end of the baseline campaign
Calculation method (if applicable)	According to applied methodology
QA/QC procedures	
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.9 UNC**
Unit	%
Description	Overall Uncertainty of the Monitoring System
Measured/calculated/ default	Calculated
Source of data	Calculated in the QAL2 test
Value(s) of monitored parameter	4.05%
Monitoring equipment	N.A
Measuring/reading/recording frequency	N.A
Calculation method (if applicable)	Data obtained from QAL2 test carried out by SGS Environmental Services.
QA/QC procedures	
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.10 AFR**
Unit	Kg NH3/hour
Description	Ammonia Gas Flow Rate to Ammonia Oxidation Reactor for the baseline campaign
Measured/calculated/ default	Measured
Source of data	Distributed Control System of MCV's plant.
Value(s) of monitored parameter	2,807
Monitoring equipment	<table><tr><td></td><td>FIT-11A04</td></tr><tr><td>Type</td><td>Flow Transmitter D/P cell Rosemount 1151DP5S22M1B1</td></tr><tr><td>Serial number</td><td>S/N: 1450154</td></tr><tr><td>Calibration Frequency:</td><td>Calibrated every campaign according to metrology procedures.</td></tr><tr><td>Dates of previous calibration:</td><td>21/07/2011</td></tr><tr><td>Validity:</td><td>Every campaign</td></tr><tr><td>Overall measurement accuracy:</td><td>0.075%</td></tr></table>
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	N.A
QA/QC procedures	

Purpose of data/parameter	Baseline emissions calculations
Additional comments	Critical instruments are calibrated on a routinely basis every campaign. Additionally the cell that measures the ammonia flow is already calibrated and the ammonia to Air ratio is calculated and recorder with the AMS data

Data/Parameter	**B.12 AIFR**
Unit	Kg NH3/hour
Description	Ammonia Gas Flow Rate to Ammonia Oxidation Reactor for the baseline campaign
Measured/calculated/ default	Measured
Source of data	Distributed Control System of MCV's plant.
Value(s) of monitored parameter	0.0607
Monitoring equipment	<table><tr><td></td><td>FIT-11A05</td></tr><tr><td>Type</td><td>Flow Transmitter D/P cell Rosemount 3051CD1A22A1JB4E5L4M6T1</td></tr><tr><td>Serial number</td><td>S/N: O536957</td></tr><tr><td>Calibration Frequency:</td><td>Calibrated every campaign according to metrology procedures.</td></tr><tr><td>Dates of previous calibration:</td><td>21/07/2011</td></tr><tr><td>Validity:</td><td>Every campaign</td></tr><tr><td>Overall measurement accuracy:</td><td>0.065%</td></tr></table>
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	N.A
QA/QC procedures	
Purpose of data/parameter	Baseline emissions calculations
Additional comments	Critical instruments are calibrated on a routinely basis every campaign. Additionally the cell that measures the ammonia flow is already calibrated and the ammonia to Air ratio is calculated and recorder with the AMS data

Data/Parameter	**B.13 CL_{BL}**
Unit	tonne 100% HNO_3
Description	Campaign length is defined as the total number of tonnes of nitric acid at 100% concentration produced with one set of gauzes.
Measured/calculated/ default	Calculated
Source of data	Distributed Control System of MCV's plant.
Value(s) of monitored parameter	84,823
Monitoring equipment	N/A
Measuring/reading/recording frequency	Calculated after the end of each campaign

Calculation method (if applicable)	Daily production is measured directly by a mass flow meter (Coriolis Principle) that records the combined Nitric acid produced by both the Nitric Acid Plant and the Caprolactam Plant; the device also measures density and temperature, so concentration correction is done automatically with the help if the DCS. The specific Caprolactam Plant production is measured by a second device of the Coriolis type. The DCS calculates the daily production of the nitric acid plant as the difference between the first (Coriolis) and second (Coriolis) device measurements.
QA/QC procedures	Procedures PR02A-P005 “Calculation Method for the Production of Nitric Acid Plant” and I-6321-053 “Instructions for Maintenance, Adjustment and Calibration of Mass Flow Transmitters Micromotion
Purpose of data/parameter	Baseline and project emissions calculations
Additional comments	

Data/Parameter	**B.16 OT_h**
Unit	ºC
Description	Oxidation temperature of the ammonia reactor for each hour.
Measured/calculated/ default	Measured
Source of data	Distributed Control System of MCV’s plant.
Value(s) of monitored parameter	5th campaign: 793.23 6th campaign: 815.69 7th campaign: 835.86
Monitoring equipment	TIT-11A10 Type: Leeds and Northrop model thermocouple type k chromel alumel cat. no. 8784 k- 1-5-36-1-3-1) sheat h 5/16 length 36" junction type cast iron with mounting bushing for temperature 2100 GF Serial number: S/N: O501882 Calibration Frequency: This Thermocouple is replaced every campaign. Dates of previous replacement: 13/05/2011 Date of last replacement: 30/03/2012 Validity: Every campaign Overall measurement accuracy: 0.002%
Measuring/reading/recording frequency	Every hour
Calculation method (if applicable)	Reactor temperature is measured by a thermocouple installed through the reactor wall, near the oxidation catalyst; the signal from such device is acquired by the Distributed Control System (DCS) and stored electronically at a given time interval. The operating range is correlated with oxidation temperature (650-900°C). This range is set taking into account the minimum operating temperature at low load and temperature shut down of the gauzes.
QA/QC procedures	This Thermocouple is replaced every campaign. In the event of a failure during the campaign the plant is shut down and the thermocouple is replaced for a new one.
Purpose of data/parameter	Baseline and project emissions calculations
Additional comments	

Data/Parameter	B.18 OP_h
Unit	Pa abs
Description	Oxidation pressure of the ammonia reactor for each hour.
Measured/calculated/ default	Measured
Source of data	Distributed Control System of MCV's plant.
Value(s) of monitored parameter	5th campaign: 3.14 6th campaign: 3.17 7th campaign: 3.26
Monitoring equipment	<table><tr><td></td><td>PIT-11A12</td></tr><tr><td>Type</td><td>Pressure Transmitter Rosemount 3051S2 G4A2A11A1JE5M5T1</td></tr><tr><td>Serial number</td><td>S/N: O144887</td></tr><tr><td>Calibration Frequency:</td><td>Calibrated every campaign according to metrology procedures..</td></tr><tr><td>Dates of previous replacement:</td><td>Installed new at the beginning of the campaign</td></tr><tr><td>Date of last replacement:</td><td>22/07/2011</td></tr><tr><td>Validity:</td><td>Every campaign</td></tr><tr><td>Overall measurement accuracy:</td><td>0.025%</td></tr></table>
Measuring/reading/recording frequency	Every hour
Calculation method (if applicable)	Not applicable. We do not use this parameter to estimate expected emission reduction.
QA/QC procedures	Critical instruments are calibrated on a routinely basis every campaign.
Purpose of data/parameter	Baseline and project emissions calculations
Additional comments	

Data/Parameter	B.21 GS_{BL}
Unit	N.A
Description	Gauze supplier for the baseline campaign.
Measured/calculated/ default	N.A
Source of data	Procurement office of MCV's plant
Value(s) of monitored parameter	W.C. Heraeus
Monitoring equipment	N.A
Measuring/reading/recording frequency	N.A
Calculation method (if applicable)	N.A
QA/QC procedures	N.A
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	B.22 $GS_{project}$
Unit	N.A

Description	Gauze supplier for the baseline campaign.
Measured/calculated/ default	N.A
Source of data	Procurement office of MCV's plant
Value(s) of monitored parameter	W.C. Heraeus
Monitoring equipment	N.A
Measuring/reading/recording frequency	Each campaign
Calculation method (if applicable)	N.A
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations
Additional comments	

Data/Parameter	**B.24 GS_{BL}**
Unit	%
Description	Gauze composition for the baseline campaign.
Measured/calculated/ default	N.A Information provided by the supplier.
Source of data	Nitric plant procurement office and gauze Supplier's Technical Service Department
Value(s) of monitored parameter	N.A
Monitoring equipment	N.A
Measuring/reading/recording frequency	Once
Calculation method (if applicable)	N.A
QA/QC procedures	N.A
Purpose of data/parameter	Baseline emissions calculations
Additional comments	

Data/Parameter	**B.25 $GC_{project}$**
Unit	%
Description	Gauze composition for the baseline campaign.
Measured/calculated/ default	N.A Information provided by the supplier.
Source of data	Procurement office of MCV's plant
Value(s) of monitored parameter	N.A
Monitoring equipment	N.A
Measuring/reading/recording frequency	Once
Calculation method (if applicable)	N.A
QA/QC procedures	N.A
Purpose of data/parameter	Project emissions calculations

Additional comments	

Data/Parameter	**B.26 EF_{reg}**
Unit	kg N_2O/tonne HNO_3
Description	Emission level set by incoming policies or regulations, local and national regulations on N_2O and NOX emissions.
Measured/calculated/ default	N.A
Source of data	Local and national regulations
Value(s) of monitored parameter	No relevant local or national regulations were introduced during the project period (there was a change in NO_X regulations but this change did not imply limitations on N_2O emission levels)
Monitoring equipment	N.A
Measuring/reading/recording frequency	To be recorded on date of introduction or change of regulation
Calculation method (if applicable)	N.A
QA/QC procedures	N.A
Purpose of data/parameter	Baseline and project emission calculations.
Additional comments	

D.3. Implementation of sampling plan

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Not Applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

For baseline emission factor determination, N_2O concentration and gas volume flow at the plant were monitored throughout the baseline campaign. Hourly average readings for N2O concentration and gas flow volume (calculated from every 2 second monitored data) were performed. Error readings (e.g. downtime or malfunction) and extreme values were eliminated from the output data series.

Normal operating conditions determination

To ensure that data obtained during baseline campaign are representative of the actual GHG emissions from the source plant, a set of process parameters known to affect N2O generation have been set based on plant historical operating conditions, appropriate technical literature and design data. Those parameters, called by the methodology normal operating conditions, are: oxidation temperature, oxidation pressure, ammonia flow to the reactor and ammonia flow to air flow ratio.

Only those N_2O measurements taken when the plant was operating within the permitted range were considered in the calculation of baseline emissions.

After eliminating data measured when the plant was operating outside the permitted conditions, the following statistical procedure was applied.

a) Calculated the sample mean (x)

b) Calculated the sample standard deviation (s)

c) Calculated the 95% confidence interval (equal to 1.96 times the standard deviation)

d) Eliminated all data that lied outside the 95% confidence interval

e) Calculated the new sample mean from the remaining values (volume of stack gas (VSG) and N_2O concentration of stack gas (NCSG))

Then, baseline emissions were calculated using the following eq. 1 and 2 from the Methodology AM0034, version 2:

$$BE_{BC} = VSG_{BC} * NCSG_{BC} * 10^{-9} * OH_{BC} \quad (1)$$

$$EF_{BL} = \frac{BE_{BC}}{NAP_{BC}} \times (1 - \frac{UNC}{100}) \quad (2)$$

Where:

- BE_{BC}: Total baseline emissions in the baseline measurement period, in, tN_2O
- VSG_{BC}: Mean stack gas volume flow rate in the baseline measurement period, in Nm^3/h
- $NCSG_{BC}$: Mean concentration of N_2O in the stack gas in the baseline measurement period, in mg N_2O/Nm^3
- OH_{BC}: Number of operating hours in the baseline measurement period, in h
- EF_{BL}: Baseline emission factor, in tN_2O/ $tHNO^3$
- NAP_{BC}: Nitric acid production during the baseline campaign, in, tHNO3
- UNC: Overall measurement uncertainty of the monitoring system, in %, calculated as the combined uncertainty of the applied monitoring equipment

Another parameter that is measured and must be compared with the normal value is the campaign length (CLn).

According to the Methodology AM0034, version 2, the baseline campaign length (CLBL) must be shorter than or equal to CLn. The average historical campaign length, prior to the baseline campaign (Normal campaign, CLnormal) is:

83,165 tonnes HNO3.

Baseline campaign took place between February 15th, 2007 and February 17th, 2008. The operating day was considered from 8:00 AM of the corresponding day to 7:00 AM of the following day. Following this criteria, baseline campaign took place between 8:00 AM of February 15th, 2007 and 7:00 AM of February 18th, 2008. Aligned with the Methodology AM0034 Ver2 and complemented with Annex 12 from EB51, when CLBL > CLnormal:

- If CLBL > CLnormal N_2O values that were measured beyond the length of CLnormal during the production of the quantity of nitric acid (i.e. the final tonnes produced) are to be eliminated from the calculation of EFBL.

The Board clarified that N_2O values in the above requirement refers to the values of concentration of N_2O of stack gas (NCS_{GBC}), therefore, while applying the above requirement of the methodology the project participants should eliminate the values for

this parameter beyond the length of CLnormal for calculating the mean values for NCSGBC.

The baseline emissions (BEBC) was calculated using this mean value multiplied by the mean value of volume of the stack gas (VSGBC) and the total operating hours (OHBC) of the baseline campaign. In calculating the EFBL, the nitric acid production corresponding to the operating hours of the total baseline campaign length (OHBC) should be used.

For baseline emission factor calculation the following periods were used:

- 0,00639- 5th campaign: February 15th, 2007 to November 30th, 2007 (See document "MCV_BLEF_calculation_for_Fifth_project_campaign-ver_1.0".xls).
- 0,00639 - 6h campaign: February 15th, 2007 to November 19th, 2007 (See document "MCV_BLEF_calculation_for_Sixth_project_campaign-ver_1.0".xls).
- 0,00696 - 7th campaign: February 15th, 2007 to January 16th, 2008 (See document "MCV_BLEF_calculation_for_Seventh_project_campaign-ver_1.0".xls).

In the case of project campaigns, the Methodology AM0034 states that campaign length must be longer than or equal to CLn. If CLn < CLnormal, baseline emission factor must be recalculated by eliminating all those N_2O values obtained during the production of tonnes of nitric acid beyond CL_n (i.e. the last tonnes produced) from the calculation of EF. As Project Campaigns were shorter than normal campaign length, EFBL was re-calculated using NCSGBC values monitored before the day in which the plant exceeded the production of each project campaigns.

Fifth project campaign:

BE_{BC}= 33,860 * 2,021* 10^{-9}* 8,466 = 579.27 tonnes N_20

EF_{BL} = 0.00655 tonnes N_20/tonnes HNO_3

Sixth project campaign:

BE_{BC}= 33,942 * 1,996 * 10^{-9}* 8,466 = 573.55 tonnes N_20

EF_{BL} = 0.00648 tonnes N_20/tonnes HNO_3

Seventh project campaign:

BE_{BC}= 33,439 * 2,256* 10^{-9}* 8,466 = 638.76 tonnes N_20

EF_{BL} = 0.00722 tonnes N_20/tonnes HNO_3

The Baseline Campaign was valid because the plant was operated within normal operating conditions for more than 50% of the duration of the baseline.

E.2. Calculation of project emissions or actual net removals

For project emission factor determination, N_2O concentration and gas volume flow for each plant were monitored throughout the project campaign. Hourly average readings f or N_2O concentration and gas volume flow (calculated from every 2 second monitored data) were performed. Error readings (e.g. downtime or malfunction) and extreme values were eliminated from the output data series. Next, the same statistical evaluation that was applied to the baseline data series was applied to the project data series.

The mean values of N_2O concentration at the stack gas and volume flow rate at the stack gas were used in the following formula (Eq. 3 and 4 from AM0034) to calculate project emissions:

$$PE_n = VSG_n \times NCSG_n \times 10^{-9} \times OH_n \quad (3)$$

$$EF_n = \frac{PE_n}{NAP_n} \quad (4)$$

Where:

- PE_n Total Project emissions of the nth campaign, in tN_2O
- VSG_n Mean stack gas volume flow rate for the nth project campaign, in Nm^3/h
- $NCSG_n$ Mean concentration of N_2O in the stack gas for the project campaign, in mg N_2O/Nm^3
- OH_n Number of operating hours in the project campaign, in h
- EF_n Emission factor calculated for the nth campaign, in ton N_2O/ton HNO_3
- NAP_n Nitric acid production in the nth campaign, in ton 100% HNO_3

The fifth, sixth and seventh project Campaigns took place:

Values obtained are:

$$EF_n = \frac{36{,}535 \times 536.09 \times 10^{-9} \times 6{,}572}{65{,}530} = 39{,}979\ tonnes\ N2O\ /\ \text{ton HNO3}$$

$$EF_n = \frac{36{,}391 \times 187.32 \times 10^{-9} \times 7{,}438}{63{,}041} = 15{,}634\ tonnes\ N2O\ /\ \text{ton HNO3}$$

$$EF_n = \frac{34{,}761 \times 1{,}393.97 \times 10^{-9} \times 8{,}179}{77{,}425} = 122{,}888\ tonnes\ N2O\ /\text{ton HNO3}$$

Derivation of a moving average emission factor:

The methodology proposes the calculation of a moving average emission factor in order to take a conservative approach in emission reduction calculation. The maximum value between EF_n for the specific project campaign and the $EF_{ma,n}$ shall be used in the emission reduction calculation as EFp emission factor. $EF_{ma,n}$ is calculated as follows (Eq. 5 and 6 from AM0034, version 2):

$$EF_{ma,n} = \frac{EF_1 + EF_2 + \cdots + EF_N}{n}$$

If $EF_{ma,n} \geq EF_n$, then $EF_p = EF_{ma,n}$

If $EF_{ma,n} < EF_n$, then $EF_p = EF_n$

Where,

- EF_n Emission factor calculated for the nth campaign, in tonne N_2O/tonne HNO_3;
- $EF_{ma,n}$ Moving average (ma) emission factor after nth campaign, including the current campaign, in tonne N_2O/tonne HNO_3;
- N Number of campaigns to date;

- EF_p Emission factor that will be applied to calculate the emission reductions from this specific campaign, in tonne N_2O/tonne HNO_3;

This process is repeated for each campaign so that a moving average, $EF_{ma,n}$, is established over time, becoming more representative and precise with each additional campaign. Values obtained are:

$$EF_{ma,n} = \frac{0.00193 + 0.00248 + 0.0037 + 0.00349 + 0.00203}{5} = 0.00266\ tonnes \frac{N2O}{tonne} HNO3$$

$$EF_{ma,n} = \frac{0.00193 + 0.00248 + 0.0037 + 0.00349 + 0.00203 + 0.00080}{6} = 0.00235\ tonnes \frac{N2O}{tonne} HNO3$$

$$EF_{ma,n} = \frac{0.00193 + 0.00248 + 0.0037 + 0.00349 + 0.00203 + 0.00080 + 0.00512}{7}$$
$$= 0.00275\ tonnes \frac{N2O}{tonne} HNO3$$

As indicated earlier, the present Monitoring Report covers the following period: 30th March 2012 to 15th February 2015.

According to AM0034 version 2, the emission reductions for the project activity over a specific campaign are determined as follows:

$$ER_n = (EF_{BL} - EF_P) \times NAP_n \times GWP_{N2O}$$

ER_n Emission reductions of the project for the nth campaign, tCO_2e

EF_{BL} Baseline emission factor, in tN_2O/ $tHNO_3$

EF_p Project emission factor, applicable to the nth campaign, in tN_2O/ $tHNO_3$

NAP_n Nitric acid production during the nth campaign of the project activity, in $tHNO_3$

GWP_{N2O} global warming potential, of N_2O set as 310 tCO_2e/tN_2O for the 1st commitment period

The value obtained for the project is:

$$ER_n = (0.00655 - 0.00266)x65{,}530 \times 310 = 76{,}611\ tonnes\ CO2$$

$$ER_n = (0.00648 - 0.00235) \times 63{,}041 \times 310 = 80{,}711\ tonnes\ CO2$$

$$ER_n = (0.00722 - 0.00512)x\ 77{,}425 \times 310 = 50{,}403\ tonnes\ CO2$$

Complete emission reduction calculation is in the following documents:

“MCV_Fifth_project campaign.xls”.

“MCV_Sixth_project campaign.xls”.

“MCV_Seventh_project campaign.xls”.

The NAP for the project campaigns did not exceed the design capacity.

E.3. Calculation of leakage emissions

No leakage calculation is required.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	428,729	178,502	0	83,853	166,375	250,228

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
250,228	366,150

E.6. Remarks on increase in achieved emission reductions

The generated emission reductions during this monitoring period are lower than expected in the PDD. This was mainly due to the fact that the N2O abatement efficiency of the catalyst for the campaign**s** was lower than **those** estimated in the PDD

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Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Document Type:	Class:	Regulatory Form
Business Function:		Issuance
Keywords: monitoring report		